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MONOGRAPHS ON EDUCATION

IN THE

UNITED STATES

EDITED BY
NICHOLAS MURRAY BUTLER
President of Columbia University in the City of New York

12

AGRICULTURAL EDUCATION

BY

CHARLES W. DABNEY
President of the University of Tennessee, Knoxville, Tennessee

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DEPARTMENT OF EDUCATION

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MONOGRAPHS

ON

EDUCATION IN THE UNITED STATES

EDITED BY

NICHOLAS MURRAY BUTLER

President of Columbia University in the City of New York

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1 EDUCATIONAL ORGANIZATION AND ADMINISTRATION — ANDREW SLOAN DRAPER, *President of the University of Illinois, Champaign, Illinois*

2 KINDERGARTEN EDUCATION — SUSAN E. BLOW, *Cazenovia, New York*

3 ELEMENTARY EDUCATION — WILLIAM T. HARRIS, *United States Commissioner of Education, Washington, D. C.*

4 SECONDARY EDUCATION — ELMER ELLSWORTH BROWN, *Professor of Education in the University of California, Berkeley, California*

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6 THE AMERICAN UNIVERSITY — EDWARD DELAVAN PERRY, *Jay Professor of Greek in Columbia University, New York*

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16 SUMMER SCHOOLS AND UNIVERSITY EXTENSION — GEORGE E. VINCENT, *Associate Professor of Sociology, University of Chicago; Principal of Chautauqua*

17 SCIENTIFIC SOCIETIES AND ASSOCIATIONS — JAMES MCKEEN CATTELL, *Professor of Psychology in Columbia University, New York*

18 EDUCATION OF THE NEGRO — BOOKER T. WASHINGTON, *Principal of the Tuskegee Institute, Tuskegee, Alabama*

19 EDUCATION OF THE INDIAN — WILLIAM N. HAILMANN, *Superintendent of Schools, Dayton, Ohio*

20 EDUCATION THROUGH THE AGENCY OF THE SEVERAL RELIGIOUS ORGANIZATIONS — DR. W. H. LARRABEE, *Plainfield, N. J.*

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AGRICULTURAL EDUCATION

The earliest farmers in America had to contend with innumerable and great obstacles; with the wildness of nature, the attacks of Indians and wild beasts upon their stock, the difficulty of obtaining farming implements and seeds, and with conditions of climate and soil, very different from those of the old countries whence they derived all their methods. The colonial farmer was compelled to use the crudest methods. He cut down, heaped and burned the small trees and undergrowth, and belted the large ones. He scratched the surface a little with a home-made plow, and cultivated his corn and tobacco with a wooden hoe. He harvested the crop that nature gave him in a careless manner and used it wastefully. He cultivated the same field until it was worn out, when he cleared another and moved his family near to it. So long as land was so abundant, no attention was paid to the conservation of fertility of the soil. America was such a vast and fertile country that it took the people over a century to find out that there was any limit to its productiveness. These conditions were quite sufficient to explain the slow progress made in agriculture during the first century or more after the settlement of America.

It was not until the close of the eighteenth century that the attention of practical men commenced to be directed to the discoveries of science, and hopes were excited that immediate benefits would accrue from them to agriculture as they had to the other arts. Lavoisier's discoveries and teachings had aroused the hope that chemistry could do a great deal to promote the advancement of farming. Americans commenced to appreciate their disadvantages as compared with British and continental farmers, and to seek better implements and methods for their work. The newly-

awakened interest in agriculture was marked first by the formation of agricultural societies. George Washington was one of the best technically educated men in America in his day, and was especially interested in everything pertaining to agriculture. His various state papers show that he not only knew the needs of the country, but that he fully realized that schools for the education of the people and societies for the distribution of knowledge were necessary for the safety of the republic. A few extracts will recall his strong opinions on this subject. In his first annual message to congress (Jan. 8, 1790) he expressed the hope that the "advancement of agriculture, commerce, and manufactures, by all proper means, will not, I trust, need recommendation," and adds, "Nor am I less persuaded that you will agree with me in the opinion that there is nothing which can better deserve your patronage than the promotion of science and literature. * * * Whether this desirable object will be best promoted by affording aids to seminaries already established, or by the institution of a national university, or by any other expedients, will be well worthy of a place in the deliberations of the legislature." Notice how agriculture and a national university for the promotion of science and arts were always associated in Washington's mind. He mentions the advancement of agriculture and the establishment of a national university in the same connection in his first message. He discusses them together in many of his writings during eight years, and finally in his eighth annual message he says, "It will not be doubted that with reference either to individual or national welfare agriculture is of primary importance. In proportion as nations advance in population and other circumstances of maturity, this truth becomes more apparent, and renders the cultivation of the soil more and more an object of public patronage. Institutions for promoting it grow up, supported by the public purse; and to what object can it be dedicated with greater propriety? Among the means which have been employed to this end,

none have been attended with greater success than the establishment of boards (composed of proper characters) charged with collecting and diffusing information, and enabled by premiums and small pecuniary aids to encourage and assist a spirit of discovery and improvement. This species of establishment contributes doubly to the increase of improvement by stimulating to enterprise and experiment, and by drawing to a common center the results everywhere of individual skill and observation, and spreading them thence over the whole nation. Experience accordingly has shown that they are very cheap instruments of immense national benefits." * * * "I have heretofore proposed to the consideration of congress the expediency of establishing a national university and also a military academy. The desirableness of both these institutions has so constantly increased with every new view I have taken of the subject that I cannot omit the opportunity of once for all calling your attention to them." With marvelous foresight Washington urged the necessity for scientific research and education in America, and he planned at the same time for institutions to discover and collect knowledge, and societies to disseminate it. He saw also that agriculture was to be the chief industry in the country, and that it would need the assistance of science. Thus he appears to have associated plans for the advancement of agriculture with those for a national university.

Congress promptly established the military academy, and some years later the naval academy and the department of agriculture. But it has not yet established the national university, which was the chief agency in Washington's mind for the development of all the sciences and arts of peace.

THE FIRST AGRICULTURAL SOCIETIES AND FAIRS

Where did Washington get this conception of the work of boards of agriculture? The first society for the promotion of agriculture in the United States was organized at Philadelphia on March 1, 1785; and on the 4th of July

following George Washington and Benjamin Franklin were elected members. A similar society was incorporated in South Carolina in the same year, which proposed, among other things, to establish an experimental farm — the first suggestion of the kind in our history. The New York society for the promotion of agriculture, arts and manufactures, which had been organized on the 26th of February, 1791, published its first small volume of transactions in 1792. The Massachusetts society for the promotion of agriculture was established March 7, 1792, and commenced, in 1797, the publication of bulletins. The Society for promoting agriculture in the state of Connecticut was organized in 1794, and published its first volume of proceedings in 1802. Washington was evidently familiar with the work of these agricultural societies; but his knowledge of such agencies was not limited to his own country. In Great Britain, the Bath and the West of England agricultural societies had been established. Sir John Sinclair, the "inventor of statistics" and president of the Highland society, had established, in 1791, the British wool society and the sheep fair at Newhalls Inn. After agitating the subject for a number of years, Sinclair secured the establishment of the Royal board of agriculture, and was appointed its first president in 1793. Washington's correspondence with Sir John Sinclair shows that he had the benefit of all the information to be obtained from the father of the British board of agriculture.

Agricultural societies naturally led to the establishment of fairs and exhibitions. A member of the Massachusetts society suggested first in 1801 that agricultural fairs should be held regularly at Cambridge spring and fall, and premiums be given for farm products. No action appears, however, to have been taken with regard to this suggestion. Dr. Thornton, the first commissioner of patents at Washington, suggested in 1804 that the sale of agricultural products and of cattle would be promoted by the holding of fairs on market days, as in England. As a result of this suggestion we learn from the "National Intelligencer" of

that year that fairs were held "in the mall on the south side of the Tiber." The first fair proved such a success that the citizens raised an appropriation of $50 for premiums for the next one, which was held in April, 1805. The third fair, held in November, 1805, appears to have been the last.

Governor Edward Winslow, of Massachusetts, is said to have brought to Plymouth, in the ship *Charity*, in 1694, "the first neat cattle that came into New England." It was appropriate that his descendant, Elkanah Watson, of Plymouth, should import the first pair of Spanish Merino sheep into Massachusetts, and should then give notice of an exhibition of them at Pittsfield. This small exhibit led to a larger enterprise and the establishment of stock shows in America. An invitation was published by Watson and some twenty other persons calling an exhibition of stock at the same place on the first of October. This cattle show was so successful that it became a permanent institution in Massachusetts. A number of public spirited citizens of Maryland, Virginia and the District of Columbia had in the meantime formed, in 1809, the Columbian agricultural society, which was for many years actively engaged in the work of educating the farmer through the agency of fairs. From these beginnings agricultural societies have spread all over our country, and agricultural fairs have become a potent agency for the dissemination of valuable information with regard to new crops, implements, stock and improvement in agriculture generally.

Nearly all of the states now have either boards of agriculture or commissioners or secretaries of agriculture in charge of the farming interests. Their work varies, but usually includes the collection of agricultural statistics, the preparation of weather and crop reports and the oversight of the stock interests, and frequently also the inspection and analysis of fertilizers and mixed cattle feeds, the testing and examination of dairy and other food products. Some of the state boards conduct the agricultural colleges, hold fairs, give premiums for fine stock and hold farmers' insti-

tutes. The boards, commissioners and societies all publish reports and bulletins and many of them accomplish a great deal of admirable educational work.

The Patrons of husbandry (Grange) and National farmers' alliance are organizations with many subordinate branches and local societies and have exerted great influence especially in educating the farmers and their families. The Farmers' national congress meets once a year for the discussion of questions of general interest. For the stock interests, we have in this country a national live stock association, five national dairy unions, and fifty-six state dairy associations. There are fourteen cattle breeders associations representing the interests of as many different important breeds, eighteen horse breeders associations, twenty-nine sheep breeders associations, seventeen associations of swine breeders, etc. Nearly all of the states protect their stock from diseases through the agency of sanitary boards or veterinarians under the direction of the state boards or commissioners.

There is a national league for good roads that is doing much to educate public opinion. Ten states have forestry commissions or provide for forest protection and improvement in some way. There are besides eighteen forestry associations which are doing much educational work. Eleven national or interstate, and fifty-four state horticultural and kindred societies are at work. (For the names of these societies and the addresses of their officers, see the Yearbook of the United States department of agriculture for 1898.)

THE RISE OF AGRICULTURAL SCHOOLS

The origin and development of agricultural schools in America was a part of a general educational movement against the old classical college and in favor of scientific and technical education. Perhaps the demand for agricultural education was the first one to be heard; but it had its origin in the same causes which gave rise to the demand for the application of science to all the arts and professions in life.

As the great universities of Europe grew out of monastic

and cathedral schools, so our first American colleges were all the children of the churches. The preachers were in the early days almost the only learned men, and therefore the only teachers. In the case of the rural schools the preacher was both school director and teacher. The institutions for higher education were also founded and controlled by the associations and presbyteries of the different denominations, and the most learned of their clergy became the instructors. Naturally enough, as their founders and teachers were all preachers, these early colleges were devoted almost exclusively to the cultivation of theology, classics and philosophy. Their parson-teachers taught what they held to be the only thing worth learning, and they were right in putting character and culture above everything else. Their methods produced a race of preachers, teachers, lawyers, statesmen, and soldiers scarcely equalled and never surpassed in any country. But a new and rapidly growing country like America needed engineers, chemists, miners, and manufacturers, and an ambitious and intelligent people were not slow to make their wants heard.

Some of the physical sciences, notably chemistry and geology, had already made great progress, and had revolutionized some of the arts. The popular writings of great scientific men, notably Liebig's Letters on chemistry, were eagerly read, and people everywhere cherished bright hopes of the benefits to be derived from the application of science to the industries of life, and especially to agriculture. Discovery and invention were already doing much to develop the material resources of the world and to change the occupations of men. Steam was beginning to be used for the purpose of transportation, chemistry was being applied in working iron, in dyeing fabrics, and in many other arts. Great railroads were to be built, but with the exception of the military academy at West Point, there was no school to train the engineers to survey them. Mines of coal and iron were to be opened, but miners had to be imported to open them. Factories needed to be built, but engineers

had to be brought over from England or Holland to build them. Iron works and many other important industries were calling loudly for chemists, who had to be obtained from Germany or France. These influences, but more especially the need of scientific knowledge in a rapidly developing country, produced a profound effect on the theories and practice of education; and thus a vigorous demand arose for the sciences and their applications to the arts of life. The old college was not meeting the new demands; but what the new college was to be, and what its methods, no one knew for a long time.

Columbia college, in the city of New York, appointed, in 1792, Samuel L. Mitchell "professor of natural history, chemistry and agriculture." The records of the college do not show what instruction he gave in agricultural science, if any, but Professor Mitchell, so far as we know, was, by title at least, the first professor of agriculture in America. We are told that he prepared a number of essays on manures and other subjects for the New York society for the promotion of agriculture, and that his influence in behalf of the sciences related to agriculture was very evident in the men he trained. Many of them became prominent in science, and some were influential in the movement for agricultural schools.

The Philadelphia Society for the promotion of agriculture, of which Washington was an honorary member, appointed a committee on January 21, 1794, "to prepare a plan for establishing the State society for the promotion of agriculture, connecting with it the education of youth in the knowledge of that most important art." This committee made a report offering several alternative propositions for promoting agricultural education. One suggestion made was "the endowment of professorships to be annexed to the University of Pennsylvania and the College of Carlisle, and other seminaries of learning, for the purpose of teaching the chemical, philosophical and elementary arts of the theory of agriculture." Another suggestion was to use the common

school system of the state to educate the farmer in his business, "the county school masters being made secretaries of the county societies, and the school houses the places of meeting and the repositories of their transactions, models, etc. The legislature may enjoin on these school masters the combination of the subject of agriculture with other parts of education." This is, so far as we know, the first formal effort made in the United States to present the claims of agricultural education to a legislature and to incorporate instruction in agriculture in the common schools.

THE BEGINNINGS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

The war with England, the expansion of territory, the rapid development of manufacturing and many other causes, contributed to retard the progress of agricultural education for several decades after the beginning of the century. The agitation continued, but little was accomplished until after 1840.

Upon the motion of Elkanah Watson, the Berkshire agricultural society of Massachusetts presented in 1817 a memorial to congress praying for "the establishment of a national board of agriculture in accordance with the original suggestion of President Washington." The bill reported in the house of representatives was promply defeated by a large vote. It was well known that President Madison was opposed to it on constitutional grounds. Others based their opposition on the indifference of the farmers of the country and the idea that such a board was not needed.

The only striking event in the agricultural history of the country during the next decade was the agitation of silk culture, commonly called the "Morus multicaulis" craze from the variety of the mulberry tree which was introduced everywhere to supply food for the silk worm. Congress responded to the popular demand for information on this subject by ordering the preparation and publication of a manual of silk culture, which was done.

The United States department of agriculture grew finally out of the recommendation of President Washington for a national board of agriculture, but more immediately out of the seed distribution originated in the department of state during the presidency of John Quincy Adams. The patent office was first in the hands of the department of state, and the seeds collected by consuls in various parts of the world were turned over to it, as the scientific branch of the government, for distribution. So it came about that when on the 4th of July, 1836, the patent office was made a separate bureau and Henry L. Ellsworth, a practical farmer of Connecticut, was appointed commissioner, he found it one of his duties to distribute seeds and plants. It was a congenial duty and one for which he was well qualified both by education and experience. During his travels over the country as Indian commissioner, Mr. Ellsworth had been deeply impressed with the agricultural possibilities of the western prairies and also with the great ignorance and destitution of the settlers upon them. He believed that what they needed was better implements and seeds adapted to the climate and soils. So deeply impressed was he with the necessities of these people that, without the authority of congress and outside of business hours, he collected seeds and plants, which he distributed to farmers in all sections of the country, but especially to those in the far west, using the postal franks of members of congress for this purpose. This was the beginning of the seed distribution by the United States government, which has since grown to such colossal proportions. Thus also was born the United States department of agriculture. In his first annual report Mr. Ellsworth begged earnestly for an appropriation to continue and enlarge this distribution of seeds and one was made during the last days of the twenty-fifth congress which provided $1,000 from the patent office fund "for the purpose of collecting and distributing seeds, prosecuting agricultural investigations, and procuring agricultural statistics." With the exception of the years 1840, 1841 and 1846 congress made a small appropriation for this purpose each

year from the patent office fund. The first separate appropriation for agriculture, made in the year 1854, was $35,000, and it has never been less than that sum. An agent was authorized also at this time to "investigate and report upon the habits of insects, injurious and beneficial to vegetation," and a botanical garden was established. The same year arrangements were made with the Smithsonian institution for collecting meteorological statistics. The present United States department of agriculture was established by an act of congress, approved by President Lincoln on May 15, 1862. This act was chiefly due to the strong plea made by Commissioner of Patents David P. Holloway, of Indiana. It is remarkable that the other great act for the promotion of agriculture in America, known as the land-grant act establishing colleges of agriculture and mechanic arts, was passed by the same congress and approved by President Lincoln on July 2nd of the same year, both in the midst of the terrors of the civil war.

The act of May 15, 1862, did not establish an independent department of the government. Its chief officer was styled simply "commissioner of agriculture." He did not become a member of the cabinet until the 11th of February, 1889, when President Cleveland approved another act of congress making the department of agriculture an executive department. The duties of the department of agriculture were (act of 1862): "To acquire and diffuse among the people of the United States useful information on subjects connected with agriculture, in the most general and comprehensive sense of the word, and to procure and propagate among the people new and valuable seeds and plants."

So much of the history of the United States department of agriculture appears necessary to this discussion of agricultural education in the United States. Through its surveys and laboratories, its experiment stations and especially through its numerous and valuable publications it has been the chief agency of agricultural education in America.

THE FIRST AGRICULTURAL COLLEGES

The demand for scientific and technical education did not cease as the years passed by, but grew louder and louder with the development of the country. The history of the agitation in New York may be taken as an illustration. In 1819 there was published anonymously at Albany a pamphlet on "the necessity of establishing an agricultural college," which has been commonly attributed to that active and intelligent man, Simeon De Witt, surveyor-general of New York. He proposed the establishment of an institution to be called the agricultural college of the state of New York, to be endowed by the state and conducted under state authority. The transactions of the New York agricultural society for 1822 contain allusions to the same subjects, and the matter was never allowed to drop entirely out of sight. About 1825 a private agricultural college or school was undertaken in Columbia county. This was the period (1830 to 1850) of the agitation for the so-called "manual labor schools," and many of the schools of the time took that form. The Oneida institute was one of the first of these schools, and it is said to have had a course of instruction in practical agriculture. These were not manual training schools or technical schools in the modern sense, but schools having farms attached where the students could support themselves by manual labor while pursuing their studies. This plan, which found much popular favor for a time and led to the establishment of numerous schools, was soon found to be impracticable and abandoned.

The demand for agricultural education in New York grew steadily, and by 1838 petitions bearing six thousand signatures were presented to the legislature demanding state aid in behalf of agricultural schools. The committee to whom the petitions were referred deplored in strong language "that there is no school, no seminary, no department of any school in which the science of agriculture is taught," and recommended very strongly the establishment of a school of

agriculture. No action was taken at this time, but the matter came up in a different form at each succeeding session of the legislature, and appears to have grown steadily in favor. The State agricultural society helped greatly to advance the interests of the cause, and in 1844 appointed a committee of which Governor Seward, Lieutenant-Governor Dickinson, and James S. Wadsworth, were members, to promote "the introduction of agricultural studies in the schools of the state," and also "for the purpose of selecting books for family and school libraries." It was resolved at the same time, "That this society regards the establishment of an agricultural institute and pattern farm in this state, where shall be taught thoroughly and alike the science, the practice, and the profits of good husbandry, as an object of great importance." This committee co-operated with the association of school superintendents, with the result that that body adopted, in June, 1844, a resolution drawn by Professor Potter, of Union college, setting forth the opinion that "the time has arrived when the elements and scientific principles of agriculture should be taught in all schools." Still the state took no action. Numerous private agricultural schools were established however.

Governor Hamilton Fish first recommended, in January, 1849, in his annual message to the legislature, the establishment of a state agricultural college. During the following session of the legislature Professor Johnson, the great agricultural chemist of Scotland, was invited to Albany and delivered a course of lectures under the auspices of the New York agricultural society. The same year this society established a chemical laboratory at Albany for the analysis of manures, fertilizers, etc. Still nothing was done about the school.

Professor William H. Brewer, from whose writings many of these facts have been derived, thus described the first industrial college established in New York: "In 1850 Mr. John Delafield, a graduate of Columbia college, where he may have received instruction from Professor Mitchell, was

living on one of the best farms of the state, in the town of Fayette, Seneca county. He was at one time president of the New York state agricultural society, and originated and carried out an agricultural survey of Seneca county. He took a deep interest in the cause of agricultural education, and owing to his action and energy on April 15, 1853, the state passed an act establishing an agricultural college. This act created a board of ten trustees, of which Mr. Delafield was president, but appropriated no money. The college was to be located on Mr. Delafield's farm in the town of Fayette, but as he died October 22 of the same year nothing more was done about building a college there." The Rev. Amos Brown, principal of Ovid academy, situated fifteen miles south of Fayette, who was to become later the chief assistant of Senator Morrill in securing the passage of the land-grant act establishing agricultural colleges, appears to have gotten his inspiration and information from Mr. Delafield. At least when the school at Fayette failed, Mr. Brown conceived the idea of having the charter of the agricultural college transferred to his academy at Ovid. He secured an act for this purpose from the general assembly in 1856, which provided a loan by the state of $40,000. The citizens of Fayette and vicinity had in the meantime subscribed about $50,000. The board of trustees was organized, buildings were erected, and the college was formally opened as the New York state agricultural college in the fall of 1860, with M. R. Patrick as president of the college. The affairs of the institution appear to have been poorly managed, however, as it was found to be too heavily in debt to begin active operations. When the civil war broke out President Patrick went off with the army, and the college was closed never again to be opened. Amos Brown afterwards became president of the People's college near Havana, New York, and after the passage of the Morrill act in 1862 secured an act from the legislature of New York giving the whole of its share of the land-grant to this college. But that institution failed to comply with the conditions of the

law, and the land-grant of the state of New York was turned over to Cornell university, which thus became the agricultural college of the state. This narrative has been introduced to show the growth of the idea which led to the establishment of Cornell university, probably our greatest agricultural institution.

The first agricultural college to be actually established and put in operation was that of the state of Michigan. Article 13, section 11 of the constitution of the state of Michigan adopted in 1850, says: "The legislature shall encourage the promotion of intellectual, scientific, and agricultural improvement; and shall as soon as practicable, provide for the establishment of an agricultural school." This was the first state constitution to provide for the establishment of an agricultural school. It is noteworthy, also, that it was the first one to provide that all instruction in the district schools should be conducted in the English language. The act establishing the state agricultural college of Michigan was passed on February 12, 1855. The college was located upon a farm of some 500 acres, situated about four miles east of the city of Lansing; buildings were erected, and the college was formally opened in May, 1847.

The legislature of Maryland incorporated the next agricultural college in 1856, which was, however, in part a private institution. Some five hundred citizens of Maryland, and of the District of Columbia, together with a few from adjacent states, subscribed to a certain amount of stock, which the legislature required should be provided. The stockholders elected a board of trustees, and this body located the college upon the estate of Charles B. Calvert, situated in Prince George county, about nine miles east of the city of Washington. The institution was opened for students in September, 1859, when Professor Joseph Henry of the Smithsonian institution, delivered a handsome oration.

Marshall P. Wilder first urged the importance of establishing an agricultural college in Massachusetts, in an address before the Norfolk agricultural society made in 1849. The

state senate of Massachusetts passed a bill in 1850 establishing such a school, but it failed in the house. A committee was appointed to investigate the matter, and they sent Professor Hitchcock to the continent of Europe to visit agricultural schools. His report was transmitted to the legislature by the governor in the following year, with the result that the Massachusetts board of agriculture was established in 1852. Mr. Wilder kept up the agitation, however, and finally in 1856 succeeded in obtaining from the legislature a charter of the Massachusetts school of agriculture. The Massachusetts agricultural college was not regularly opened, however, until 1867.

The general assembly of the state of Pennsylvania incorporated the Farmers' high school, now the State college, in 1854. The act provided that people of different sections of the state might offer land and property and thereby secure its location in their midst. Funds for building and equipment were provided from the state treasury. The State agricultural society made certain donations, and the college was opened for students in the winter of 1859. These were the leading agricultural schools established before the passage of the land-grant act in 1862.

Closely related to these agricultural schools were the scientific schools established at Yale and Harvard between 1840 and 1850, in response to the same demand for a new education. John P. Norton was appointed professor of agricultural chemistry, vegetable and animal physiology at Yale college, New Haven, Connecticut, in 1846. Thus was begun the Sheffield scientific school, which was more of an agricultural institution than any of the other schools of that time. Professor Norton began his lectures in 1847, and for some years wrote voluminously for agricultural journals. He also prepared and published his first work, The Elements of agriculture. Among his first students in the course in agricultural chemistry was the distinguished Professor W. H. Brewer, of the Sheffield scientific school at Yale. The Lawrence scientific school at Harvard, established about

the same time, was founded upon an endowment of $40,000, given by the Lawrences, who, being interested in factories, caused this school to direct its attention more to the applications of chemistry to manufactures.

Francis Wayland, president of Brown university, became greatly interested at this time in scientific and technical education, and took a prominent part in the discussion of the reforms needed to adapt the institutions of America to the requirements of the time. In his little book on the Present collegiate system of the United States he argued earnestly in favor of the introduction of scientific subjects into the college curriculum and the adoption of a system of electives. A science hall and a museum of geology were erected at Brown in 1840; but means failed to support the scientific work, and Dr. Wayland was constrained to resign in 1855, when the old classical course was re-established. These changes were all parts of a general movement for the modification of the classical curriculum, and the introduction of scientific and technical study. Wherever this was done the sciences pertaining to agriculture were sure to be introduced.

THE LAND-GRANT COLLEGES

As the plans for the new college education won support in these states, the friends of the cause took courage to conquer new fields. Their activity was soon extended from the halls of state legislation to those of the government at Washington. The agitation first voiced itself there in petitions to congress for national aid for agricultural colleges. After several years the friends of the movement secured the interest and co-operation of Justin S. Morrill, then a member of the house of representatives from the state of Vermont, who was destined to be known as the father of the agricultural colleges and to live to see them firmly established in all the states and territories in the union and well supported by congressional appropriations, made in three acts, secured largely by his efforts extending over thirty years. Mr. Morrill introduced the first bill in the lower

house on December 14, 1857, and saw the last one approved on August 30, 1890. His first bill authorized the establishment of colleges in all the states and provided 20,000 acres of public land for each member of congress for their maintenance. The committee on public lands, to which it was referred, brought in an adverse report on April 15, 1858. The bill however passed both houses at the following session, but was vetoed by President Buchanan. Nothing daunted by this defeat, Mr. Morrill introduced a new bill in the house in December, 1861, bestowing 30,000 acres of land for each member of congress upon the several states for the establishment of industrial colleges. Ben Wade of Ohio introduced the bill in the senate on May 2. It passed both houses in spite of an adverse report by the house committee on public lands, and was approved by President Lincoln July 2, 1862, the day of McClellan's retreat after the battle of Malvern Hill in Virginia. We have shown how President Lincoln approved the bill for the department of agriculture on May 15 preceding. In the midst of the excitement of the great war little attention was paid to this most remarkable gift of about 13,000,000 acres of land to promote the cause of education. Having been passed during a war, it is not surprising that the act provided that every college receiving the benefits of the land-grant should give its students instruction in military science.

This great grant, the greatest ever made to education, which was the foundation of industrial education in America, and represented the consummation of a great revolution in the system of higher instruction in this country, demands somewhat careful study. The act was entitled "An Act donating public lands to the several states and territories who may provide colleges for the benefit of agriculture and the mechanic arts." It granted to each state an amount of public land equal to 30,000 acres for each senator and representative in congress to which the states were entitled by the apportionment of the census of 1860. The object of the grant is expressed in remarkably broad terms, as follows:

"The endowment, support and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." This paragraph has been the subject of a vast deal of discussion which must be briefly noticed. First, let us hear what Senator Morrill himself has said with regard to its meaning. Says he: "It is perhaps needless to say that these colleges were not established or endowed for the sole purpose of teaching agriculture. Their object was to give an opportunity for those engaged in industrial pursuits to obtain some knowledge of the practical sciences related to agriculture and the mechanic arts; such as they could not then obtain at most of our institutions called classical colleges, where the languages, Greek and Latin, French and German, absorbed perhaps two-thirds of all of the time of the students while in college. But it was never intended to force the boys of farmers going into these institutions so to study that they should all come out farmers. It was merely intended to give them an opportunity to do so and to do so with advantage if they saw fit. Obviously not manual but intellectual instruction was the paramount object. It was not provided that agricultural labor in the field should be practically taught, any more than that the mechanical trade of a carpenter or blacksmith should be taught. Secondly, it was a liberal education that was proposed. Classical studies were not to be excluded, and therefore, must be included. The act of 1862 proposed a system of broad education by colleges, not limited to superficial and dwarfed training such as might be supplied by a foreman of a workshop or by a foreman of an experimental farm. If any would have only a school with equal scraps of labor and of instruction, or something other than a college, they would

not obey the national law. Experience in manual labor, in the handling of tools and implements, is not to be disparaged; in the proper time and place it is most essential, and generally something of this may be obtained either before or after the college term, but should not largely interfere with the precious time required for a definite amount of scientific and literary culture, which all earnest students are apt to find far too limited." The chief contention with regard to the meaning of the act has always and everywhere been over the question whether these colleges should be mere schools of practical agriculture and mechanic arts, or institutions for liberal education as well. This utterance of Senator Morrill, made many years after the bill was passed, should settle this question forever.

In the first place, we learn that the general object of the act was to provide for the scientific and liberal education of industrial classes, who were not sufficiently provided for in the old-fashioned classical colleges. The new institution was to be a college, that is, an institution of higher education. It was not to be a mere farm or shop, or even a manual labor school; but an institution where the sons of farmers and mechanics and of other members of the industrial classes could get, at a moderate cost, both a "liberal and practical education." By "liberal" education was always meant in those times a literary and classical education. The act recognized fully the correlation of all knowledge and the necessity of subordinating all to the great objects of the law, by forbidding the exclusion of "other scientific and classical studies." But it was to be "a college where the *leading* object should be to teach *such branches of learning as are related to agriculture and the mechanic arts*" — not practical agriculture merely, or practical mechanics merely, but *the branches of learning* related thereto.

In the second place, these institutions were to educate, not exclusively, but especially, as has been said, the industrial classes. At the time they were founded almost the only institutions for higher education were classical colleges pat-

ronized by the sons of the wealthy, who usually became literary men, teachers, preachers, lawyers, and physicians. For years the great demand had been for instruction in the branches of learning which qualify men in the industrial pursuits. Therefore these colleges were designed especially to fill this great gap in our educational system and to give the sons of the industrial classes the opportunity to get any kind of an education they wanted. The sons of these industrial classes, however, were not to be limited to agriculture and the mechanic arts, for the law says, they shall receive "a liberal and practical education," which would qualify them for "the several pursuits and professions of life."

These colleges established another new principle in education in America, the principle of free tuition in the highest schools of learning. Liberal education is a necessity in a free government; heretofore only the sons of the rich were able to get it. A government of the people, for the people, and by the people can be perpetuated only by educating all the people. It is not sufficient that we have in America a magnificent system of common schools. The highest education must be within the reach of all the worthy poor. As Butler has said, "The attempt to feed elementary education on itself alone is perpetual motion transformed. Strike at the human heart effectually, and the listless fingers close in death; strike at the source of scholarship and supply, and every remotest part of this body politic falls back stricken or weak." Or as Atherton has said, "Higher education is as the ocean to the mountain spring, continually sending back the dew and the rain to supply them. It is as the tree to the fruit, continually imparting vitality and substance. It is as the sun to the planets, holding all in their appointed course. From the higher institutions come not only teachers to lead and guide the lower, but that great body of learning and intelligence which creates, molds, and enriches public sentiment, which supports the common school." These national colleges first gave all the people, rich and poor alike, the opportunities for getting the best education.

Thirdly, it is to be noted that these colleges are not class institutions. Though designed to guarantee them these opportunities they are not limited to the industrial classes. They are intended to supplement existing institutions and provide free tuition for all classes, the sons of professional men, as well as mechanics. As Senator Morrill has said in another place, "I should hope that no farmer or mechanic would be so illiberal as to wish to have the monopoly of education in any of these land-grant colleges." They are, in brief, the colleges of all the people, of every class and profession, and they are intended to give all alike the opportunities for the broadest education. As Ezra Cornell expressed it, they are institutions "where any person can find instruction in any subject." This purpose has been wonderfully well accomplished by the majority of them in the thirty years of their existence. By giving the higher education to rich and poor, these colleges have done more to render permanent American institutions than any other institution founded by congress.

American institutions of learning have often been ridiculed for their extravagance in "brick and mortar." The average board of trustees of an American college has a strong disposition to buy land and lay off extensive lawns and parks, and to expend money in large buildings, and then to starve its professors and pinch them in the matter of books and equipment. This was especially true in the earlier days. Seeing how many institutions had ruined their usefulness in the extravagant external management of their affairs, and desiring to stimulate states and local communities to do their share in upbuilding these colleges, the law said, "that no portion of said fund nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building or buildings."

This provision has been the cause of a great diversity of practice as to the manner of providing the necessary buildings and grounds for these institutions. Whether the col-

lege should be an independent institution or whether it should be connected with some existing college was the first question raised in every state. The state either had to make large appropriations for buildings and grounds or else connect the new institution with some old one. There were always old institutions wanting the new endowment, and the competition between them was frequently a warm one. The arguments in favor of connecting them with existing institutions were the saving of the cost of buildings and grounds, of museums and libraries, etc., and the difficulty of providing corps of professors in many of the subjects, which had to be taught, especially the literary ones. Other arguments were found in the scarcity of competent professors for the new institutions and in the theory, taught clearly in the act itself, that the new education was to be built upon the old, the practical and the liberal going hand in hand. The arguments in favor of independent agricultural colleges were the danger of having the new fund absorbed for the purposes of the old education, the danger of ill feeling or conflict between the technical and the classical students, and the supposed incompatibility of the study of abstract and applied science.

A very wise provision of the act is the one which makes the exact character of the institution and the nature of the instruction to be given a matter for the decision of the legislatures of the states. The instruction should be adapted to the needs of the people and the character of the industries of the several states. The sciences related to the mechanic arts hold just as important a place in this law as those related to agriculture; and this term is evidently intended to be interpreted in the same liberal sense in which we have interpreted the terms "agriculture" and "branches of learning related to agriculture." The branches of learning related to mechanic arts comprehend all the sciences not included among those related to agriculture. In some of our states agriculture is the chief industry, while manufacturing is the largest interest in others. Under this provision

the state may itself determine which group of sciences shall receive the chief attention. The act has been properly interpreted thus to provide courses of industrial education to suit the needs of the different states and has rarely been abused.

Believing that the time had arrived when the agricultural and mechanical colleges should have additional support, Mr. Morrill and the other friends of industrial education in the United States began in 1889 to formulate plans to secure a second appropriation from the national treasury. Mr. Morrill introduced another bill in congress providing for the further endowment of the colleges, which passed and was approved by President Harrison on August 30, 1890. This act, generally known as the second Morrill act, provides that there shall be appropriated annually to each state out of the funds arising from the sale of public lands, as in the case of the agricultural experiment stations, the sum of $15,000, for the year ending June 30, 1890, and an annual increase by the additional sum of $1,000, to such appropriation for ten years thereafter until the appropriation shall become $25,000, at which figure it shall remain fixed. The act says that this appropriation shall be applied "only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic science, with special reference to their applications to the industries of life, and to the facilities for such instruction." Provision was made at this time for separate institutions for white and colored students in such states as desired to make this arrangement. Being limited in its application this act has done even more than the original one to stimulate industrial education in the United States.

CLASSIFICATION OF AGRICULTURAL COLLEGES

The early agricultural colleges and schools have in nearly all cases been merged into the colleges established under the land-grant act of 1862. The act establishing colleges of agriculture and mechanic arts was a broad one, and was framed purposely so as to permit the states to organize col-

leges adapted to their particular needs. As a result it is very difficult to classify them. Under this law there have been organized almost all grades of agricultural schools, from those of the high school grade to great universities with extensive departments for scientific research.

According to their type of organization, they may be broadly divided into two classes: First, separate colleges of agriculture and mechanic arts; secondly, universities having departments of agriculture, and usually also of engineering. Of the earlier institutions having only courses in agriculture, only one remains, the Massachusetts agricultural college, referred to above. All of the other institutions established first as colleges of agriculture, pure and simple, have organized departments of mechanic arts in obedience to the law. Many have become great institutions of technology, with departments for many arts. In some colleges like those of Mississippi and Texas, the agricultural department preponderates largely, as it should always do in great agricultural states having very little manufacturing. The tendency in all the colleges is to multiply the courses of study in sciences applied to the arts and to cover all the technical pursuits of the states. For example, in several of the southern states, where cotton manufacturing is growing, departments have been organized for instruction in the textile industry. Unless large additional appropriations are provided by the states for this purpose, it were better to limit the courses undertaken to a few of the most important ones. The tendency at the present time, however, is to build up all of these technical department schools around the state university or the agricultural and mechanical college having these funds.

Sixty-five institutions have been organized in the several states and territories under the acts of congress of July 2, 1862, and August 30, 1890. At least one institution is now in operation in each state and territory except Alaska. Of the sixty-one colleges having regular courses in agriculture, twenty-seven may be classified as separate colleges of agriculture and mechanic arts, and nineteen as universities

having departments of agriculture and engineering. Separate institutions for colored students have been established in accordance with the act of 1890 in eight southern states. Instruction in them has usually been limited for the most part to courses below the college grade and to the industrial arts suited to the needs of the negro. Seven remain unclassified above.

REQUIREMENTS FOR ADMISSION

The requirements for admission to the agricultural colleges vary very much in the different states in accordance with the school systems and the other opportunities for preparation. The western and southern agricultural colleges usually take the students from what is known in this country as the eighth or ninth grade of the public school course. A majority of the institutions require for admission either certificates from the preparatory schools or examinations in the more important subjects.

The average standard of admission to the agricultural colleges is presented in the report of the committee on entrance requirements made to the association of colleges at the meeting in November, 1896. They recommended the following (Rept. of Bureau of education, 1896–97, p. 429):

"The committee holds that it is advisable, as a beginning, to determine the requirements in a few subjects upon which it is possible for all the colleges to agree, and to recommend others, which, although too high at present for adoption by some of these institutions, may yet serve as a standard or goal toward which effort may be directed.

"As a standard series of entrance requirements, to be adopted as soon as possible, we recommend the following:

1. Physical geography.
2. United States history.
3. Arithmetic, including the metric system.
4. Algebra to quadratics.
5. English grammar and composition, together with English requirements of the New England association.
6. Plane geometry.

7. One foreign language.
8. One of the natural sciences.
9. Ancient, general, or English history."

Many of the universities have a much higher standard of admission, some of them requiring a preparation fairly comparable with that for students entering the literary and scientific courses. Candidates for admission at Cornell, for example, must be at least sixteen years of age and pass an examination in English, geography, physiology and hygiene, history of the United States and England, Greece or Rome, plane geometry, elementary algebra, and at least two of the following subjects: Greek, Latin, French, German and advanced mathematics.

COURSES OF STUDY

The courses of study in the separate colleges for agriculture and mechanic arts are not essentially different from those of the agricultural departments of the state universities, with the exception that in most cases the work of the separate colleges begins a little earlier and is not so much differentiated as that in the universities. Many of the separate agricultural colleges have, however, quite as high requirements for admission as any of the state universities, and do as high a grade of work as the best of them. On the whole, it appears that practical agriculture occupies the highest place in the separate colleges, though more research in the sciences pertaining to agriculture is being carried on in the universities. In universities in which departments of agriculture are maintained, it may be said in general that the tendency is to make the four years' course in agriculture correspond in scope and thoroughness with those in philosophy, sciences and engineering. As more means are obtained, instruction in agriculture is divided among an increasing number of specialists, who are provided with separate buildings, laboratories and shops. It is characteristic of American state universities that they are seeing more and more clearly that agriculture and manufacturing are important human

interests which may rightfully claim the best efforts of the greatest scientific intellects for their advancement, and that on the basis of agricultural sciences may be built a system of instruction in literature, mathematics and technology which is as well or better adapted to produce scholars, investigators and leaders in civilization as was the old philosophical or the pure science course.

The courses of study in agriculture are variously arranged. Nearly all these institutions maintain a four years' course, which is made up usually of two years of preparatory sciences and general culture studies, followed by two years of more advanced scientific and technical agricultural work, largely elective. At present there is little demand in our country for the all-around agricultural expert, and few colleges attempt to educate them. Such an expert cannot be trained in four years, if at all. When the demand for such a thoroughly-trained expert arises, he will have to begin his training in the preparatory school and carry it up through the college and the university. But this time is far off. At present the agricultural colleges content themselves with giving their students a fair general knowledge of the sciences underlying agriculture, horticulture, and the animal industry, with opportunities to acquire experience in some one line of practical work. The arrangement of this four years' course differs a good deal in different institutions, but the standard for it is laid in the reports adopted by the association of American agricultural colleges at its meetings in 1896–97. The following paragraphs from that report give the plan of this course as at present given in the best institutions:

"Before proceeding to consider in detail the topics which should be included in a course of agriculture, and the methods to be pursued in teaching agricultural subjects, the committee has deemed it essential to determine the general relation of a course in technical agriculture to the other courses of study which should be connected with this to form a four years' course in an agricultural college. This

task was made simpler by the previous work of the committee on entrance requirements, courses of study, and degrees, whose report, adopted at the last meeting of this association, suggests certain requirements for entrance and specifies certain subjects as desirable in all courses given in the colleges in membership with this association.[1] In the following suggestions regarding a four years' course in agriculture, this committee conforms to that report."

That portion of the report of the committee on entrance requirements, which relates to the subject essential to all courses, is as follows:

"In the judgment of your committee, it is not too much to require the equivalent of fifteen hours per week of recitations and lectures, together with ten hours per week of laboratory work, or practicums, including the time devoted to military science and drill. Upon this basis the above-mentioned general studies should be assigned a relative importance, approximately, as follows:

	Hours
Algebra	75
Geometry	40
Trigonometry	40
Physics (class-room work)	75
Physics (laboratory work)	75
Chemistry (class-room work)	75
Chemistry (laboratory work)	75
English	200
Modern languages	340
Psychology	60
Ethics or logic	40
Political economy	60
General history	80
Constitutional law	50
Total	1,285

"The total number of hours included in a four years' course, allowing fifteen hours per week for thirty-six weeks,

[1] See United States Department of agriculture, Office of Experiment stations, bulletin 41, p. 52.

would be 2,140; with ten hours' laboratory work, or practicums, added, 3,600. In general terms, therefore, the foregoing general studies should comprise about two-fifths of the work required for a bachelor's degree."

"Your committee on methods of teaching agriculture suggests additional subjects to be included in a four years' course in agriculture leading to the degree of bachelor of science, as follows:

	Hours
Agriculture	486
Horticulture and forestry	180
Veterinary science (including anatomy)	180
Agricultural chemistry (in addition to general requirement)	180
Botany (including vegetable physiology and pathology)	180
Zoology (including entomology)	120
Physiology	180
Geology	120
Meteorology	60
Drawing	60
Total	1,746

In reckoning the number of hours, two hours of laboratory work, or practicums, are considered the equivalent of one hour of recitation. In this way the total number of hours in a four years' course is made 2,900, instead of 3,600, as proposed by the committee on entrance requirements."

"Your committee also submits the following suggestions regarding the course of study to be included under the head of 'Agriculture.' In this part of its work the committee has followed the general divisions of agriculture proposed in its previous report. The number of hours to be assigned to each of these general subjects is stated, as well as the main topics to be included under each general subject, and, in some cases, the text-books which may be used in connection with the teaching of particular subjects. These books are, however, named because they are considered by your committee as the best text-books now available on the subjects. They may also serve to show in a general way

what would properly be included in the course under the several topics to which they apply. Some notes regarding equipment requisite for teaching the different branches included in this scheme are also given. The number of hours assigned to the different subjects is intended to apply to the average conditions of a four years' course in agriculture. Local conditions will, of course, call for more or less modifications of the scheme here proposed."

"Agriculture (486 hours) shall include:

	Hours
1. Agronomy, or plant production	132
2. Zootechny, or animal industry	162
3. Agrotechny, or agricultural technology	72
4. Rural engineering, or farm mechanics	60
5. Rural economics, or farm management	60
Total	486

Synopsis of Course in Agriculture

Agronomy ..... 132 hours.

	Texts.
Climate, Soils, Tillage, drainage and irrigation	F. H. King — The Soil.
Fertilizers	I. P. Roberts — The Fertility of the Land.
Plant production, Farm crops	G. E. Morrow and T. F. Hunt — Soils and Crops.

Zootechny ..... 162 hours.

Principles of breeding ..... M. Miles — Stock Breeding.

Breeds of live stock .... G. W. Curtis — Horses, Cattle, Sheep and Swine.

Stock, feeding, care, and management .. H. P. Armsby — Manual of Cattle Feeding.

(Animal physiology to be taught under 'Physiology;' anatomy and animal diseases under 'Veterinary science.')

Agrotechny ..... 72 hours.

Butter making ..... H. H. Wing — Milk and its Products. H. B. Gurler — American Dairying.

Cheese making ..... J. W. Decker — Cheddar Cheese Making.

(Other topics, such as sugar making, wine or olive oil making, may be taught under this head in different parts of the United States.)

Rural engineering..... 60 hours.
Roads, drains, irrigation systems, farm buildings, and machinery.
Rural economics..... 60 hours.
History of agriculture.
Farm management, rural law, farm accounts."

The course of study presents the largest problem now before the faculties of our colleges. The present courses and methods have been criticised for their lack of "pedagogical form," for the "confusion of studies," and especially for lack of "orderly sequence in the progress of instruction" which has made the classical education and to a certain degree the scientific and engineering courses of our institutes of technology processes commanding the respect of scholars the world over. These critics are in error when they speak of agriculture as an independent science, and propose to formulate the instruction in it as they would that in chemistry or in biology. The fact is, agriculture is not a science but an art, and what we are attempting to do in these colleges is to carry out the injunction of the act of congress of 1862 and "teach the sciences (chemistry, physics, geology, biology, vegetable physiology, etc., each including numerous branches), related thereto." For this reason the course of study in agriculture with good "pedagogical form" must be made up of a course in chemistry and agricultural chemistry, a course in vegetable physiology, a course in the physiology of animals, a course in soil physics, etc. — many distinct courses. When the student has mastered all these it would seem to be possible, if he stays at the college long enough, to teach him in good "pedagogical form," some of their applications in agriculture. As Professor Jordan, director of the Maine agricultural experiment station, has well said (Report of bureau of education, 1896–97, p. 454): "The real and important need of which the farmer is conscious is for a knowledge of conditions and not for methods or for skill in manipulation. When he clearly understands the reasons for that which goes on

about him, the right method will appear. The difficulties lie with explanations, not with mechanical processes. And besides, agriculture is not a business involving such delicate and intricate mechanical operations that attendance upon a college would be justified in order to learn them, although the modern dairy, the forcing house, and the fruit garden do require skill. But I venture to assert that no machines or practical methods have yet become available to the agriculturist whose use the clear-brained inmates of our farm homes have failed to master. The spraying of fruit with fungicides and insecticides illustrates how readily the necessary manipulation was acquired when the reasons for these operations became evident. It is the explanation of phenomena, then, which the extended course of study should give in order that the farmer may know how to adapt himself to the varying and complex conditions which he meets in his work."

This is the real problem and one which the colleges and universities are working out with marked success.

Perhaps the colleges and universities having departments of agriculture are doing more immediate good to the largest number of persons through their short courses and their special schools for dairying, horticulture, etc., than through the long course. These short courses are designed to meet the wants of young farmers who desire practical, helpful instruction in agriculture after leaving the high schools and before taking up their chosen vocations. A number of the colleges maintain courses in agriculture of twelve weeks beginning the first of January of each year. They usually include lectures on feeds and feeding, breeds of live stock, elementary agricultural chemistry, physics of soils, meteorology, elements of vegetable physiology, the chief facts of veterinary science, dairying, horticulture, and some of the leading facts of bacteriology. Courses are selected from these to meet the needs of special classes of students from different districts. Laboratory practice is usually given in soil physics, stock judging, dairying, vegetable physiology, and practical horticulture. Other short courses are limited

to the chemistry and bacteriology of milk and practical dairying, or to plant propagation, grafting, pruning, and practical horticulture. These courses are more largely attended than the four years' course. The tendency at present seems to be to split up the four years' course into special courses or to distribute among the different short courses students who cannot attend the institution more than a few months at a time. It is encouraging to note that such students frequently return winter after winter for additional training.

MILITARY INSTRUCTION

As has been stated, the land-grant act, establishing colleges of agriculture and mechanic arts, was passed in the midst of the civil war. The supporters of the Union had learned through bitter experience that the great need of the army was trained officers. The chief object of the college was to be, as has been explained, the education of the industrial classes; but the secondary object was the training of young men in military matters who would be ready to serve their country in any future emergency. It will be interesting to notice, therefore, what has been actually accomplished by military departments of these colleges. Forty-two land-grant colleges have fully organized military departments. In the spring of 1898 these colleges had military organizations varying in size from one company to a whole regiment, having nearly 572 officers, 1,456 non-commissioned officers, and nearly 7,000 privates, making a total of about 9,000 cadets under training. It is estimated that about 15,000 young men have completed the course of military instruction in these colleges during the last ten years, and it is evident that a large number of them will be available for military service in case of need. An effort was made by the writer to ascertain the number of officers commissioned in the Spanish-American war who received their education in these institutions. It was difficult to secure complete statistics, but the partial reports received show that 1,092 young men from these colleges were commissioned by the president in the regular and volunteer armies during the last war.

EXPENSES OF STUDENTS

The expenses of students in the agricultural colleges of the United States vary much with the location and advantages offered. The tuition is uniformly free to all students pursuing the agricultural courses. It is customary to charge small fees to cover the actual expenses of material used in the laboratories and shops. Students pay their own board and personal expenses. Some institutions give free lodgings, though a majority charge only the actual cost of the maintenance of the buildings, fuel, lights, etc. Many institutions have special funds with which to pay for student labor, which usually takes the form of a fixed allowance for work regularly performed. The total college expenses of a student will vary from $150 for a session of nine months at a western or southern college, located in the country, to $400 or $500 at a university in one of the eastern states. More assistance and more opportunities for self-support are offered agricultural students than any others in our institutions. The tendency everywhere is to increase these opportunities and to reduce the expense of the students of agriculture, while all the facilities provided them are constantly improved.

EXTENSION WORK IN AGRICULTURE

The farmers' institute is to the adult farmer what the agricultural school is to his son. They were the outgrowth in part of the public meetings of agricultural societies and state boards of agriculture, and in part of the extension work of colleges and universities. The object of these institutes is to bring the workers in the agricultural sciences and the practical agriculturists together for the discussion of questions of mutual interest. Through such discussion the farmer gets the benefit of the information which the scientist has obtained in the course of his investigations, and the scientist learns what the farmer's needs and difficulties are. The results of the practical tests made by the farmer of the scientist's theories are also brought out. By such con-

ferences both classes of workers have their opinions and experiences broadened.

Institutes in the United States are carried on under all conceivable auspices; most commonly, however, by the state commissioners, the state boards of agriculture, or the agricultural colleges. In some states there is an independent organization with a secretary of institutes in charge. Some states make special appropriations for institutes, others merely allow a limited amount of the funds appropriated for the board of agriculture or college to be used for this purpose. Institutes are held usually during the winter or after the crops are "laid by" in midsummer, when the farmer has most time to spare, and continue in session from one to three or four days. The programs are arranged to promote the interchange of ideas between the farmers and the scientists, every effort being made to draw out a full and free discussion of the topics introduced by the addresses or papers of specialists. The best plan is to secure the assistance of an equal number of scientific experts and experimental farmers, the latter being selected, as far as possible, from the district where the institute is held. A local committee arranges for halls, music, literary and general exercises. The people of the community are usually attracted in large numbers, especially at the evening sessions when more popular subjects are discussed. Subjects connected with good roads, public education, and the interests of the home and farm are also discussed frequently. Those connected with sectarian religion or partisan politics should be carefully excluded, but almost any other topic of interest to the local community may properly find its place on the program of a farmers' institute. In states where institutes have been carefully planned and systematically conducted by competent persons they have become exceedingly popular, with the result that large appropriations are being made for them each year. Something like the farmers' institute is now held in almost all the states in the Union.

Closely related to the farmers' institute are the various

other methods of agricultural college extension work, such as co-operative field experiments, correspondence courses in agricultural sciences, reading circles for farmers, and itinerant agricultural schools. Co-operative field experiments were inaugurated soon after the establishment of the colleges for agriculture. The college or station makes plans and supplies the fertilizers or gives prescriptions for the same, with full directions as to methods of carrying out the experiments. The farmers report upon blanks prepared for the purpose, and the different results are compared and published. A great deal of good has been accomplished in this way, especially in educating farmers as to the proper method of using chemical manures. Similar methods have been used in testing seeds of field and garden crops, and in testing insecticide and fungicide materials and methods. Such co-operative experiments have done much to promote the study of scientific agriculture in the states, and especially to develop habits of observation among the younger farmers, who are always the ones to take hold of this work.

Instruction by correspondence and by courses of home reading in agriculture have been well developed under the direction of the State college of Pennsylvania. The main features of the plan are, "first, a carefully prepared course of reading designed to cover the most important branches of agricultural science and practice; second, a reduction of the price upon the books needed; third, personal advice and assistance through correspondence; fourth, examinations upon the subjects read, with certificates and diplomas for those attaining a certain grade of excellence." "This course has atttacted great attention at home and received numerous applications from farmer students, many of whom have done excellent work, completed the prescribed courses, and received certificates." The courses have now been extended to include five subjects, with five books in each one; namely, crop production, animal production, horticulture, dairying, and domestic economy. A supplemental list of fifteen books is suggested from which students may select reading matter

to form additional courses if they desire. The full course consists of the thorough study of ten books, followed by an examination. Lessons are provided from the various books, and sent the students free of cost, in the form of printed slips. They give suggestions for study, observation and experiment, with references to the books recommended. Each lesson is accompanied by an examination paper covering the particular subject. The students are expected to file answers to all these questions and discuss them before they receive the second lesson.

The itinerant agricultural school, a still later scheme, has been best developed in the state of New York, under the so-called Nixon bill, "for the purpose of horticultural experiments, investigation, instruction, and information in New York." This bill placed the sum of $35,000 under the control of the college of agriculture at Cornell university for the two years 1899–1900, and has enabled it to inaugurate a number of most interesting and promising experiments in promotion of agricultural knowledge, especially of nature study in the common schools. The itinerant agricultural school is one only of the plans now being tested by this institution. The meetings of these schools last two or more days, at which time certain instructors take up definite lines of instruction, giving by far the greater part of their attention to underlying principles and not to mere facts or methods.

AGRICULTURE IN THE COMMON SCHOOLS

From the earliest time it has been the idea of the friends of agricultural education that instruction in this subject should be given in the common schools. The subject has been presented to the legislatures of many of the states, and by some it has been required to be taught. For evident reasons, this instruction has, until comparatively recently, amounted to very little. Any real instruction in agriculture must be based upon a knowledge of chemistry, geology, and the physiology of plants and animals. Such a knowledge cannot be given to young children, and the old-fashioned

school teacher trained to study books and not things, could give no instruction in nature or science. The whole system of education had to be revolutionized to prepare the way for the study of agriculture in the schools. Since the introduction of the natural method great progress has been made. Agricultural colleges have trained the professors, who in normal schools have taught the teachers, who in turn have introduced the new methods in the common schools. This is the only way to promote the study of agriculture among country people who never get to college. The study of nature and of agriculture in the rural and village schools is, as we shall see, one of the latest developments in education in this country.

The following description of the Cornell attempt to introduce nature teaching into the rural schools is condensed from the article on "Popular education for the farmer" by A. C. True, Ph. D., director of the Office of experiment stations, in the Year-book of the Department of agriculture for 1897. p. 284 *et seq.*

"It was conceived that the fundamental difficulty with our agricultural condition was that there was no attempt to instruct the children in matters which will awaken an interest in country life, and therefore that the place in which to begin to correct the agricultural status was with the children and the rural schools. For the purpose of determining what should be done, many rural and village schools were visited during the past year and simple lessons were given on natural objects. The result was that all the instructors were impressed with the readiness with which the children imbibed the information, their keen desire for it and appreciation of it, and the almost universal interest which teachers took in this kind of work. It was clear that the greatest good which could be rendered to the agricultural communities was to awaken an interest in nature study on the part of teachers and children. In order to facilitate teaching in this direction, leaflets were issued to show teachers how nature study should be presented to the pupils, and these have been

received with the greatest enthusiasm by educators and many others who have examined them.

"The outgrowth of this work with the schools is that it seems certain that the best way in which to reach the pupils and the teachers is by short and sharp observations upon plants, insects and other natural objects, and not by means of definite lectures of stated lengths.

"Instruction by means of correspondence has been an outgrowth of the last year. There were about 1,600 readers upon the lists at the close of the first three months. It is the plan in this reading course to set the farmers to reading upon certain definite subjects, and then to make them think upon those subjects by periodical questioning. Some months ago the college of agriculture had enrolled under the head of 'university extension work' 15,000 pupils and 10,000 teachers of the public schools and 1,600 young farmers. The pupils and farmers receive guidance by means of printed circulars, and the farmers report progress and difficulties upon special blanks which are furnished. Six instructors are employed throughout the state in conducting university extension work, and special teachers are employed from time to time as occasion requires. These instructors meet the teachers of the public schools in the presence of their pupils and at teachers' associations and institutes for the purpose of illustrating methods for teaching nature studies directly related to agriculture. The leaflets furnished serve as texts for subjects taught. The result of pushing this educational motive into the rural communities has been a most decided waking up of those communities, which, even if the work were to stop at the present time, will continue to exert an influence for a generation and more.

"All this work has been experimental — an attempt to discover the best methods of teaching the people in agriculture. The promoters of this movement believe that the most efficient means of elevating the ideals and practice of the rural communities are as follows, in approximately the order of fundamental importance: (1) The establishment

of nature study or object lesson study, combined with field walks and incidental instruction in the principles of farm practice in the rural schools; (2) the establishment of correspondence instruction in connection with reading courses, binding together the university, the rural schools and all rural literary or social societies; (3) itinerant or local experiment and investigation, made chiefly as object lessons to farmers, and not for the purpose, primarily, of discovering scientific facts; (4) the publication of reading bulletins which shall inspire a quickened appreciation of rural life, and which may be used as texts in rural societies and in the reading courses, and which shall prepare the way for the reading of the more extended literature in books; (5) the sending out of special agents as lecturers or teachers or as investigators of special local difficulties or as itinerant instructors in the normal schools and before the training classes of the teachers' institutes; (6) the itinerant agricultural school, which shall be equipped with the very best teachers, and which shall be given as rewards to the most intelligent and energetic communities.

"There is every reason to believe that the plan of 'nature teaching,' as proposed by Cornell university, may prove a grand success and be a very great benefit to farmers' children. The element of education which is at present most lacking in our common schools is the training of the powers of observation. The children need above all things else to be taught to observe carefully and correctly and to state their observations in clear terse language. The ordinary child, whether on the farm or in town, actually sees comparatively little in the world about him. The wonders of the trees and plants in park or meadow, of birds and insects flying about the house, float like shadowy visions before his eyes. 'Seeing, he sees not.' He needs a teacher who can open his eyes and fix his mind on the realities among which his daily life is passed. This accurate observation of natural objects and facts is the only foundation on which scientific attainments can rest. The scientist is chiefly a man who

sees better than his fellow men. But it is also a great help in practical life. Many farmers acquire much of this power by their own unaided efforts. And these are the very men who most regret that they did not have in early life the help of a trained teacher. The farmer's child lives where he has the best opportunity for such training. It would benefit him in the practice of his art, and it would add an interest to his life which would do much to wean him from a desire to leave the farm for the turmoil and uncertain struggles of the town. With proper provision for the training of teachers in normal and other schools, it would be entirely feasible to have this nature teaching in all our common schools within a few years. It is such teaching that the child mind craves. With it the school becomes a delightful place and the teacher an angel of light."

"Thus far only a few attempts have been made in this country to provide agricultural instruction of the high school grade. It is true that some of the agricultural colleges receive students directly from the common schools, but the constant tendency is to raise the grade of instruction in these institutions to a college basis and, under any conditions, they very imperfectly perform the duties of secondary schools of agriculture. The University of Minnesota has in recent years maintained a school of agriculture in which instruction in agriculture of a lower grade than that given in the college of agriculture has been successfully imparted. This school has proved quite popular. Some 300 students were in attendance last year, and it has been found desirable to offer courses for girls as well as boys. The state of Alabama has recently provided for the maintenance of a school of agriculture of secondary grade in each of the nine congressional districts of the state.

"The establishment of such special schools of agriculture of high school grade is greatly to be commended. One of the best effects of such schools at the present time is to show the people what distinctions should be drawn between colleges and high schools for agricultural education. By the

separation of these grades of instruction the colleges will be enabled to do their work more efficiently, and better opportunities will be secured for those students whose previous training only fits them for high-school work in agriculture. But it is not believed that these special agricultural high schools will fully meet the needs of our farmers for agricultural instruction of this grade. Any school so distant from the farmer's home as to necessitate long journeys and residence at the school for two or more years must necessarily be too expensive for most of the farmers' children, especially after they have reached an age when their services may be more or less utilized on the farm. What is needed is courses in agriculture in numerous schools to which farmers' children resort, near their homes, to 'finish' their education after they are through with the common schools."

STATISTICS OF THE LAND-GRANT COLLEGES

The statistics of the land-grant colleges have been summarized in tables accompanying this paper which were condensed from those published by the United States department of agriculture.

In 1898 the numbers of teachers in the faculties of the colleges of agriculture and mechanic arts was 1,722; the officers in the agricultural experiment stations connected therewith numbered 604. The students in attendance upon them in 1898 were as follows: In preparatory classes 6,593, in collegiate classes 20,466, graduate students, 878, total students (counting those in short courses), 31,658. The graduates in 1898 numbered 2,328 and since the opening of these colleges 34,168. The number of volumes in the libraries of these institutions was 1,221,226. The number of acres of land in grounds and farms was 20,713. (See Table 1 for details.)

The aggregate value of the permanent funds and equipment of the 64 land-grant colleges in the United States was estimated in 1898 to be: Land-grant funds of 1862, $10,170,550; other permanent funds, $16,858,712. The farms and grounds owned by them were worth $6,046,500;

buildings, $15,185,476, apparatus and machinery, $3,299,365; library and miscellaneous, $3,399,433; total, $53,632,852. (Table 2.)

The income of these institutions exclusive of that of the experiment stations was in 1898: From land-grant fund of 1862 and other permanent funds, $1,232,613; from the United States appropriation under act of 1890, $1,108,610; from state appropriation, $2,370,719; from fees and miscellaneous, $1,306,437; total, $6,018,379. The value of the additions to the permanent endowment and equipment of these colleges in 1898 is estimated at $2,796,351. (Table 3.)

Professor Reber of the Pennsylvania state college has made a comparison of the endowments and revenues secured from the land-grant in the several states, using the reports for 1897. The following paragraphs are taken from his paper:[1]

"The great disparity (see our Tables 2 and 3) in the amount of national aid received by the various states is to be accounted for less by the fact that different amounts of land were received, than by the differences in the management and disposal of the lands granted. Kansas, notably, though her grant was among the smallest (90,000 acres), has disposed of her land to such excellent advantage that she is in receipt of one of the best incomes derived from this source. Pennsylvania received 780,000 acres of land, and has from this large grant an income of but $25,637.43. New York received 990,000 acres of land, and from this her university eventually realized $6,662,700, an average of $6.73 per acre. Had Pennsylvania disposed of her land at the same rate her state university would have received $5,249,000 instead of $439,186 (as was the case), and her annual income from this source would have been $314,964. The following figures further illustrate these differences: Minnesota, with 120,000 acres, has an annual income from the land grant of $27,410. California's 150,000 acres yield

[1] Comparative view of endowment and income of land-grant colleges, by Louis E. Reber.

an annual income of $43,619.33. Iowa's 240,000 acres yield annual income, $47,729.75. Michigan's 240,000 acres, yield annual income, $31,450. Kansas's 90,000 acres, yield annual income, $50,689. Colorado still holds a large part of her land-grant. Missouri, too, holds a large amount of land (136,000 acres), and this with the condition that it shall not be sold for less than $7 an acre, whereby will eventually be added to her endowment not less than $952,000. Statistics relating to the state of New York have been almost entirely omitted on account of the unique position of Cornell university among the land-grant colleges. She has reaped the benefit of the foresight and philanthropy of Ezra Cornell and others in so large a revenue that she has not (until recently, at least) desired state aid."

"Many of the states, recognizing the munificence of the national government in appropriating so large a sum in the interest of higher education, have ratified their acceptance of the obligation to carry on successfully what the nation has begun, by laying a definite tax for this purpose. This tax yields, in all cases, a maintenance fund only, provision for buildings being made by special appropriation. Other states have assured maintenance to their state institutions by making a fixed annual appropriation. Thirty-nine of the land-grant colleges have, in one way or the other, secured definite annual state aid." (See Table 3.)

"The state of California has given its university over 2,000,000 acres of land, from which is realized $109,000 annually. From a fixed state tax (1-10) this university received in 1897 $128,415.16. These amounts, together with a special appropriation made by legislature, added to those received from the national appropriations, gave her in 1897 an income of over $300,000. In 1898 and thereafter this income will be increased, the fixed state tax of 1-10 of a mill having been changed to 2-10 of a mill. This magnificent provision is independent of special appropriations in which, also, the state of California has been extremely liberal."

"Minnesota gives 23-100 of a mill annually. Colorado gives 6-10 of a mill. Wisconsin divides the tax for her university, giving a certain millage for administrative expenditure, other millage for general instruction and one per cent of the railroad tax to the school of engineering. Her total tax receipts for the state university were, in 1897, $283,000."

"Ohio's millage (1-10) gives at the present time over $177,000, though the amount shown on the chart is only $118,900. This discrepancy is due to the fact that the annual tax rate for the university was increased in January, 1897, and the sum charted is for the college year 1896 and 1897. Nebraska had at one time a millage which yielded an income to the university of $170,000."

THE ORIGIN OF THE AGRICULTURAL EXPERIMENT STATIONS

Research in the sciences related to agriculture was always prominent in the minds of the advocates of agricultural education. After the agricultural colleges were firmly established and the work of instruction was well under way, it became evident that the department of research in these institutions needed a special endowment and to be placed under a somewhat separate management. The funds provided were not sufficient for the purposes of instruction, and research and experiment were in danger of being neglected at the colleges so thronged were they with the young people who came to secure the benefits of this free tuition.

Several of the land-grant colleges early attempted to establish separate departments for scientific research and practical experiments on the plan of the German experiment stations. The act establishing the agricultural college of Maryland, passed in 1856, contained a section requiring the college to establish a model farm and conduct "a series of experiments upon the cultivation of cereals and other plants adapted to the latitude and climate of the state of Maryland, and keep a careful record of the kind of soil upon which they were undertaken, the system of cultivation adopted, the state of the atmosphere, and all other particulars which may be

necessary to a fair and complete understanding of the results of said experiments." This work was commenced in 1858 and continued two or three years only, when the civil war stopped all the operations of the college. When Connecticut established her agricultural school in connection with the Sheffield scientific school of Yale college, Samuel W. Johnson was appointed professor of agricultural chemistry, and experimental work was commenced. "To the influence of the professors and pupils trained in this school, more than to any other single cause, is due the recognition of the importance of the establishment of agricultural experiment stations." (True.)

In 1870 the trustees for the Massachusetts society for promoting agriculture granted to Harvard college a sum of money "for the support of a laboratory and for experiments in agricultural chemistry to be conducted upon the Bussey estate." A school of agriculture and horticulture had been founded upon the bequest of Benjamin Bussey. The work of the new institution commenced in 1871. The experiments consisted of field tests of fertilizers, and chemical analyses of commercial manures. The first report was published in December 1871. Other interesting and valuable work was done the next few years, but the commercial crisis of 1873 crippled the institution financially, and it has since been able to make comparatively few original investigations.

At a meeting of the state board of agriculture of Connecticut on December 17, 1873, Professor S. W. Johnson of New Haven, and Professor W. O. Atwater of Wesleyan university, urged the establishment of an agricultural experiment station "after the European pattern." The result of this movement was that the state of Connecticut made, in 1877, an appropriation of $5,000 "to promote agriculture by scientific investigation and experiment." This station was first connected with the chemical laboratory of Wesleyan university, at Middletown, which had been established by Orange Judd and was in charge of Professor Atwater, but after two years it was reorganized under the direct control

of the state and permanently located in the neighborhood of New Haven. The state of North Carolina established an agricultural experiment and fertilizer control station in connection with the state university at Chapel Hill, on March 12, 1877. The Cornell university experiment station was organized by the faculty of that institution in February, 1879, without any special appropriation. The New Jersey station was organized in 1880. The Tennessee experiment station in 1882. From these beginnings the experiment stations multiplied in the states until in 1887, when congress passed the experiment station act, there were 17 stations already in existence. This act, known from its great advocate Mr. William H. Hatch of Missouri, as the Hatch act, provided that $15,000 should be appropriated each year out of the funds arising from the sale of public lands in each state and territory, for the establishment of an agricultural experiment station as a department of each of the land-grant colleges. Those states which had established independent experiment stations prior to the passage of the act were allowed, however, to turn over this fund to the stations so established. Section 2 defined the duties of these stations as follows: That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing

directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or or territories.

The stations were also authorized to publish annual reports of their operations, and "bulletins or reports of progress" at least once in three months, which should be sent to "each newspaper in the state, and such individuals actually engaged in farming as may request the same." The franking privilege was given for station publications. In the annual appropriation bill for the department of agriculture for the fiscal year ending June 30, 1889, congress established the office of experiment stations as a branch of the department of agriculture. This is a clearing house for the experiment stations. It compiles and publishes the results of their work, and aids them in many ways. The following statistics are taken from the last report of the department of agriculture (page 1002 of Experiment station record, 1899):

"Agricultural experiment stations are now in operation under the act of congress of March 2, 1887, in all the states and territories. Agricultural experiments have been begun in Alaska with the aid of national funds, and an experiment station is in operation in Hawaii under private auspices. In each of the states of Alabama, Connecticut, New Jersey, and New York a separate station is maintained wholly or in part by state funds, and in Louisiana a station for sugar experiments is maintained partly by funds contributed by sugar planters. Excluding the branch stations established in several states, the total number of stations in the United States is 54. Of these, 52 receive the appropriation provided for in the act of congress above mentioned. The total income of the stations during 1898 was $1,201,921.17, of which $720,000 was received from the national government, the remainder, $481,921.17, coming from the following sources: State governments, $341,097.94; individuals and communities, $177.20; fees for analysis of fertilizers, $54,977.30; sales of farm products, $65,356.25; miscella-

neous, $20,312.48. In addition to this, the office of experiment stations had an appropriation of $35,000 for the past fiscal year, including $5,000 for the Alaskan investigation. The value of additions to equipment of the stations in 1898 is estimated as follows: Buildings, $109,851.65; libraries, $11,700.73; apparatus, $19,195.43; farm implements, $10,800.27; live stock, $13,151.33; miscellaneous, $11,972.97; total, $176,469.41.

"The stations employ 669 persons in the work of administration and inquiry. The number of officers engaged in the different lines of work is as follows: Directors, 75; chemists, 148; agriculturists, 71; experts in animal husbandry, 10; horticulturists, 77; farm foremen, 29; dairymen, 21; botanists, 50; entomologists, 46; veterinarians, 26; meteorologists, 30; biologists, 11; physicists, 11; geologists, 6; mycologists and bacteriologists, 19; irrigation engineers, 7; in charge of sub-stations, 15; secretaries and treasurers, 23; librarians, 10, and clerks, 46. There are also 21 persons classified as superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc. Three hundred and five station officers do more or less teaching in the colleges with which the stations are connected.

"During 1898 the stations published 406 annual reports and bulletins. Besides regular reports and bulletins, a number of the stations issued press bulletins, which were widely reproduced in the agricultural and county papers. The mailing list of the stations now aggregate half a million names."

The work of the American agricultural experiment station supplements that of the colleges in many most important ways. It is fully described in the admirable publications issued by the office of experiment stations of the United States department of agriculture, to which the reader is referred for fuller information.

STATISTICS OF LAND-GRANT (AGRICULTURAL AND MECHANICAL) COLLEGES IN THE UNITED STATES[1]

TABLE I—Officers, Students, Graduates, Volumes in Libraries, Acres in Farms, etc.

STATE OR TERRITORY	Post Office.	Name of Institution.	Date of establishment of institution	Officers		Students				Graduates		Number of volumes in library	Number of acres in farm and ground
				College of agriculture and mechanic arts	Experiment station officers	Preparatory classes	Collegiate	Post graduate	Total	Number in 1898	Total number since organization		
Alabama	Auburn	Polytechnic Institute	1872	31	11	29	287	23	341	48	500	13 462	240
Alabama	Normal	Normal and Industrial School (for colored)	....	11	....	440	18	....	458	33	429	3 500	182
Arizona	Tucson	University of Arizona	1891	15	11	99	57	....	156	4	10	3 100	.....
Arkansas	Fayetteville	Industrial University	1872	33	8	62	207	....	478	13	216	14 407	160
Arkansas	Pine Bluff	Branch Normal College (for colored)	....	8	....	129	87	4	319	10	100	3 750	20
California	Berkeley	University of California	1868	72	27	.....	1 917	20	2 391	247	3 424	153 500	424
Colorado	Fort Collins	Agricultural College of Colorado	1877	25	18	45	292	7	344	13	115	10 989	800
Connecticut	Storrs	Storrs Agricultural College	1881	13	6	.....	113	....	113	14	163	7 000	300
Delaware	Newark	Delaware College	1870	13	6	.....	88	3	101	10	339	18 000	14
Delaware	Dover	College for Colored Students	1892	7	....	27	19	....	46	2	2	700	97
Florida	Lake City	Agricultural College	1884	15	7	46	152	2	200	12	49	2 500	140
Florida	Tallahassee	State Normal and Industrial Coll. (for colored)	1887	7	....	169	2	....	218	.....	24	1 140	135
Georgia	Athens	College of Agriculture and Mechanic Arts	1872	21	7	.....	105	5	110	11	264	37 005	120
Georgia	College	Industrial College (for colored)	....	11	....	110	50	....	160	7	11	520	86
Idaho	Moscow	University of Idaho	1892	21	11	161	84	3	248	8	17	15 600	112
Illinois	Urbana	University of Illinois	1867	99	10	199	696	78	1 582	90	1 188	41 088	665
Indiana	Lafayette	Purdue University	1874	64	11	.....	693	57	750	72	910	10 952	90
Iowa	Ames	State College of Agriculture and Mechanic Arts	1869	59	21	71	560	5	636	88	978	11 458	840
Kansas	Manhattan	State Agricultural College	1863	42	12	77	669	57	803	69	802	33 040	323
Kentucky	Lexington	Agricultural and Mechanical College	1865	18	9	81	248	9	430	19	191	9 325	100
Kentucky	Frankfort	State Normal School for Colored Persons	1887	5	....	36	21	....	147	12	67	883	30
Louisiana	Baton Rouge	State University and Agricultural and Mechanical College	1877	20	20	88	.....	4	250	12	.....	22 000	.....
Louisiana	New Orleans	Southern University and Agricultural and Mechanical College (for colored)	1880	13	....	381	62	....	443	16	116	1 396	104
Maine	Orono	University of Maine	1865	34	12	.....	317	7	324	43	530	20 000	373
Maryland	College Park	Maryland Agricultural College	1859	17	13	23	81	1	105	13	.....	2 800	286
Massachusetts	Amherst	Massachusetts Agricultural College	1867	22	22	.....	133	9	142	11	508	18 760	404
Massachusetts	Boston	Massachusetts Institute of Technology	....	54	....	.....	1 191	7	1 198	193	1 960	60 163	.....
Michigan	Agri. College	State Agricultural College	1855	42	19	.....	470	5	475	29	763	25 000	676
Minnesota	Minnapolis	University of Minneapolis	1869	58	13	164	2 551	185	2 890	185	2 540	52 000	300

Mississippi	Agri. College	Agricultural and Mechanical College	1880	21	12	92	200	4	296	15	230	14 177	1 960
Mississippi	Westside	Agricultural and Mechanical Coll. (for colored).	1871	14	....	224	24	....	248	1	101	8 320	300
Missouri	Columbia	School of Agriculture and Engineering	1870	30	13	.....	818	....	818	42	.....	.....	718
Missouri	Rolla	School of Mines and Metallurgy	....	10	....	.....	115	2	117	5	88	5 258	20
Missouri	Jefferson City	Lincoln Institute (for colored)	....	3	....	69	51	....	120	20	126	325	43
Montana	Bozeman	College of Agriculture and Mechanic Arts	1893	18	7	183	18	....	201	4	7	5 500	185
Nebraska	Lincoln	Industrial College of the Univ. of Nebraska	1869	47	19	141	345	37	523	44	241	40 000	332
Nevada	Reno	State University	1873	19	7	92	178	4	328	19	85	10 877	36
New Hampshire	Durham	College of Agriculture and Mechanic Arts	1866	21	11	7	134	2	143	19	192	9 346	342
New Jersey	New Brunswick	Rutgers Scientific School	1864	33	8	144	151	1	296	41	353	41 562	.....
New Mexico	Mesilla Park	College of Agriculture and Mechanic Arts	1869	17	15	134	80	1	215	8	21	4 316	200
New York	Ithaca	Cornell University	1865	58	21	.....	1 669	166	1 835	260	4 755	246 278	270
North Carolina	West Raleigh	College of Agriculture and Mechanic Arts	1889	.....	20	29	201	15	.....	.....	87	.....	500
North Carolina	Greensboro	Agricultural and Mechanical College for the Colored Race (for colored)	....	.....	....	.....	52	....	.....	.....	.....	.....	25
North Dakota	Agri. College	Agricultural College	1890	20	12	175	59	3	237	6	13	9 015	640
Ohio	Columbus	State University	1870	25	....	.....	.....	....	1 150	71	876	30 339	345
Oklahoma	Stillwater	Agricultural and Mechanical College	1891	11	11	98	76	....	174	7	16	7 200	200
Oregon	Corvallis	State Agricultural College	1868	26	11	.....	321	15	336	29	291	5 800	198
Pennsylvania	State College	Pennsylvania State College	1855	47	18	40	304	3	347	44	414	13 408	400
Rhode Island	Kingston	College of Agriculture and Mechanic Arts	1888	25	12	.....	144	7	183	10	53	14 250	180
South Carolina	Clemson College	Clemson Agricultural College	1889	29	14	240	227	10	447	25	62	.....	1 102
South Carolina	Orangeburg	Normal, Industrial, Agricultural and Mechanical College (for colored)	1896	21	....	489	71	....	560	12	28	750	130
South Dakota	Brookings	Agricultural College	1881	19	12	48	352	....	400	19	133	15 400	400
Tennessee	Knoxville	University of Tennessee	1794	30	10	.....	251	14	608	31	.....	27 500	231
Texas	College Station	Agricultural and Mechanical College	1871	22	15	.....	334	3	337	23	332	8 500	2 416
Texas	Prairie View	Prairie View State Normal School (for colored)	....	8	....	.....	.....	....	190	.....	.....	1 196	.....
Utah	Logan	Agricultural College	1888	21	11	279	164	4	447	5	52	8 850	108
Vermont	Burlington	University of Vermont and State Agri. College.	1865	20	13	.....	292	1	575	36	3 174	.....	120
Virginia	Blacksburg	Polytechnic Institute	1872	31	11	.....	294	39	333	17	263	3 750	404
Virginia	Hampton	Hampton Normal and Agricultural Institute (for colored)	1865	79	....	811	309	....	1 120	.....	987	9 641	795
Washington	Pullman	Agricultural College and School of Science	1892	23	8	192	162	2	380	11	23	5 166	236
West Virginia	Morgantown	West Virginia University	1867	38	13	174	322	22	644	45	536	.....	100
West Virginia	Farm	West Virginia Colored Institute	1891	8	....	91	.....	....	91	.....	800	.....	.....
Wisconsin	Madison	University of Wisconsin	1848	57	18	272	1 466	23	1 767	164	3 556	68 000	400
Wyoming	Laramie	University of Wyoming	1887	11	8	65	112	8	185	11	57	9 750	356
		Total	....	1 722	604	6 593	20 466	878	31 658	2 328	34 168	1 221 226	20 713

1 Condensed from the report of "Statistics of Land-grant Colleges and Experiment Stations" for 1898, published by the Office of Experiment Stations, United States Department of Agriculture.

TABLE II—Land-grant and other Permanent Funds, Buildings and Equipment — Value of

STATE OR TERRITORY	Post Office	LAND-GRANT UNDER ACT 1862		Other permanent funds	Farm and grounds owned by the institution — value of	Buildings — value of	Apparatus and machinery — value of	Library and miscellaneous — value of	Total
		Number of acres allotted to State under act of 1862	Produced value — land-grant fund of 1862						
Alabama	Auburn	240 000	$253 500 00	.....	$6 000 00	$144 500 00	$41 040 00	$42 773 00	$487 813 00
Alabama	Normal	.....	.....	.....	10 000 00	50 000 00	5 831 41	1 304 00	67 135 41
Arizona	Tucson	.....	.....	.....	3 000 00	86 600 00	41 000 00	6 533 46	137 133 46
Arkansas	Fayetteville	150 000	130 000 00	.....	9 600 00	230 000 00	28 704 00	15 750 00	414 054 00
Arkansas	Pine Bluff	.....	.....	.....	.....	18 000 00	20 000 00	4 500 00	42 500 00
California	Berkeley	150 000	731 183 30	$2 109 537 90	1 125 554 00	702 110 84	.....	356 384 12	5 024 770 16
Colorado	Fort Collins	90 000	68 612 09	150 000 00	48 468 00	151 709 80	55 306 95	25 752 28	499 849 12
Connecticut	Storrs	180 000	135 000 00	23 000 00	15 000 00	76 000 00	7 500 00	10 000 00	265 500 00
Delaware	Newark	90 000	83 000 00	.....	3 000 00	79 700 00	32 500 00	20 000 00	218 200 00
Delaware	Dover	.....	.....	.....	6 000 00	14 000 00	3 600 00	1 000 00	24 600 00
Florida	Lake City	90 000	151 783 00	.....	7 635 00	31 245 00	11 042 00	14 465 00	216 170 00
Florida	Tallahassee	.....	.....	.....	9 605 00	15 000 00	3 000 00	2 000 00	29 605 00
Georgia	Athens	300 000	243 000 00	.....	7 000 00	300 000 00	110 000 00	60 000 00	720 000 00
Georgia	College	.....	8 000 00	.....	15 000 00	10 500 00	800 00	700 00	35 000 00
Idaho	Moscow	90 000	.....	912 410 67	6 600 00	128 900 00	45 500 00	7 500 00	1 109 910 67
Illinois	Urbana	480 000	464 083 85	150 000 00	150 000 00	800 000 00	150 000 00	75 000 00	1 789 083 85
Indiana	Lafayette	390 000	340 000 00	.....	70 000 00	345 000 00	258 500 00	16 500 00	1 030 000 00
Iowa	Ames	204 000	591 354 01	131 431 45	34 400 00	400 000 00	150 000 00	20 000 00	1 327 185 46
Kansas	Manhattan	82 314	503 478 70	720 00	39 700 00	228 438 60	97 256 55	68 899 16	938 493 01
Kentucky	Lexington	330 000	165 000 00	.....	275 000 00	124 000 00	52 000 00	11 700 00	627 700 00
Kentucky	Frankfort	.....	20 925 00	6 335 00	1 873 25	116 092 74	2 800 00	2 000 00	50 025 00
Louisiana	Baton Rouge	.....	.....	.....	.....	.....	.....	.....	.....
Louisiana	New Orleans	.....	.....	.....	22 000 00	45 320 00	7 337 36	7 346 40	82 003 76
Maine	Orono	210 000	118 300 00	100 000 00	9 325 00	200 900 00	56 350 00	44 500 00	529 375 00
Massachusetts	Amherst	360 000	219 000 00	141 575 35	45 000 00	216 000 00	14 000 00	29 000 00	664 575 35
Massachusetts Inst. of Techn.	Boston	.....	.....	1 882 850 59	.....	535 000 00	.....	200 000 00	2 617 850 59
Maryland	College Park	.....	115 943 00	9 000 00	28 600 00	71 000 00	27 000 00	.....	251 543 00
Michigan	Agricultural College	235 682	625 790 98	8 831 173 00	47 320 00	297 996 55	79 023 30	86 640 57	1 225 083 13
Minnesota	Minneapolis	94 000	510 000 00	752 439 22	500 000 00	1 000 000 00	140 000 00	125 000 00	3 027 439 22
Mississippi	Agricultural College	207 920	98 575 00	.....	42 605 00	132 655 00	38 242 94	47 370 81	359 448 75
Mississippi	Westside	270 000	113 375 00	16 814 50	2 500 00	65 000 00	1 000 00	4 000 00	202 689 50
Missouri	Columbia	275 016	349 881 19	77 000 00	153 506 00	205 500 00	.....	118 925 00	904 812 19
Missouri	Rolla	.....	87 472 80	62 000 00	6 000 00	50 000 00	8 000 00	20 009 00	233 472 80

Missouri	Jefferson City	.....	.....	.....	4 300 00	70 000 00	17 000 00	321 00	91 621 00
Montana	Bozeman	90 000	.....	248 000 00	10 000 00	110 000 00	40 000 00	15 000 00	423 000 00
Nebraska	Lincoln	90 000	61 955 15	102 170 34	200 000 00	450 000 00	115 000 00	115 000 00	1 044 125 49
Nevada	Reno	90 000	93 000 00	37 458 75	16 000 00	140 183 67	25 171 03	46 875 13	358 688 58
New Hampshire	Durham	150 000	80 000 00	40 000 00	20 500 00	185 710 85	36 267 58	18 002 57	380 481 00
New Jersey	New Brunswick	210 000	116 000 00	500 000 00	366 500 00	.....	.....	64 880 00	1 047 380 00
New Mexico	Mesilla Park	.....	.....	.....	10 000 00	50 500 00	24 785 00	10 900 00	96 185 00
New York	Ithaca	990 000	688 572 12	5 612 004 72	103 468 91	1 692 903 95	238 905 07	896 403 05	9 232 257 82
North Carolina	West Raleigh	300 000	125 000 00	.....	27 000 00	78 000 00	15 600 00	8 600 00	254 200 00
North Carolina	Greensboro	.....	.....	.....	3 000 00	64 000 00	8 000 00	18 000 00	76 800 00
North Dakota	Agricultural College	90 000	.....	900 000 00	25 000 00	90 000 00	13 600 00	15 500 00	1 044 100 00
Ohio	Columbus	630 000	524 176 30	26 292 97	1 500 000 00	700 000 00	400 000 00	70 000 00	3 220 469 27
Oklahoma	Stillwater	.....	.....	.....	5 000 00	20 000 00	23 000 00	7 500 00	55 500 00
Oregon	Corvallis	90 000	132 430 00	.....	14 500 00	53 000 00	18 000 00	10 000 00	227 930 00
Pennsylvania	State College	780 000	427 290 50	89 709 50	40 000 00	750 000 00	60 000 00	20 000 00	1 387 000 00
Rhode Island	Kingston	50 000	50 000 00	.....	182 000 00	180 900 00	89 565 94	11 625 00	514 090 94
South Carolina	Clemson College	.....	95 900 00	58 539 39	26 280 00	220 000 00	50 000 00	17 000 00	467 719 39
South Carolina	Orangeburg	.....	.....	.....	.....	.....	.....	.....	.....
South Dakota	Brookings	120 000	.....	1 238 000 00	9 250 00	93 000 00	30 000 00	.....	1 370 250 00
Tennessee	Knoxville	.....	396 000 00	29 000 00	286 250 00	162 400 00	23 633 50	56 842 94	954 126 44
Texas	College Station	180 000	209 000 00	.....	48 320 00	298 065 00	.....	53 095 45	608 480 45
Texas	Prairie View	.....	.....	.....	.....	.....	.....	.....	.....
Utah	Logan	200 000	.....	.....	10 800 00	145 000 00	37 502 46	5 450 00	198 752 46
Vermont	Burlington	150 000	135 500 00	376 000 00	24 000 00	478 644 95	99 000 00	134 000 00	1 247 144 95
Virginia	Blacksburg	.....	344 312 00	.....	30 000 00	140 000 00	.....	65 769 50	580 081 50
Virginia	Hampton	300 000	172 156 00	708 360 00	52 000 00	496 000 00	.....	136 000 00	1 564 516 00
Washington	Pullman	190 000	.....	.....	15 000 00	100 000 00	36 000 00	20 000 00	171 000 00
West Virginia	Morgantown	.....	90 000 00	24 750 00	5 000 00	300 000 00	113 000 00	33 800 00	566 550 00
West Virginia	Farm	.....	.....	.....	2 500 00	45 000 00	6 000 00	32 000 00	56 700 00
Wisconsin	Madison	240 000	302 000 00	255 000 00	300 000 00	1 200 000 00	260 000 00	105 000 00	2 422 000 00
Wyoming	Laramie	100 000	.....	.....	9 540 00	102 000 00	32 000 00	11 325 00	154 865 00
	Total	9 559 241	$10 170 549 99	$16 858 712 08	$6 046 500 16	$15 185 476 95	$3 299 365 09	$3 399 433 44	$53 632 852 25

TABLE III — Income from Land-grant Fund, Government and State Appropriations, and Other Sources — Additions to Equipment in 1898.

STATE OR TERRITORY	Post Office	Interest on land-grant and other permanent funds	United States appropriation (act of 1890)	State appropriations, regular and occasional	Fees and miscellaneous sources of revenue	Total revenues	Additions to buildings and equipment in 1898
Alabama	Auburn	$20 280 00	$12 523 48	$9 988 30	$2 968 25	$45 760 03	$8 518 00
Alabama	Normal		10 476 50	4 000 00		14 476 50	1 533 00
Arizona	Tucson		23,000 00	10 700 00	2 539 31	36 239 31	4 280 85
Arkansas	Fayetteville	10 400 00	16 727 30	34 650 00	3 930 00	65 707 30	11 300 00
Arkansas	Pine Bluff		6 272 70	9 000 00	450 00	15 722 70	975 00
California	Berkeley	112 622 79	23 000 00	385 141 39	13 443 64	534 207 82	94 200 37
Colorado	Fort Collins	3 504 12	23 000 00	36 500 00	730 69	63 734 81	45 562 44
Connecticut	Storrs	6 750 00	24 000 00	15 000 00		45 750 00	200 00
Delaware	Newark	4 980 00	18 400 00		2 826 43	26 206 43	3 400 00
Delaware	Dover		4 600 00			4 600 00	
Florida	Lake City	9 107 00	11 500 00	4 355 78	2 543 83	27 506 61	4 107 00
Florida	Tallahassee		12 000 00	4 000 00	389 00	16 389 00	4 000 00
Georgia	Athens	16 954 14	15 333 34		1 050 00	33 337 48	31 415 00
Georgia	College	8 000 00	7 666 67			15 666 67	
Idaho	Moscow	500 00	23 000 00	6 000 00	622 03	30 122 03	12 900 00
Illinois	Urbana	14 366 95	23 000 00	210 000 00	35 545 55	282 912 50	106 570 94
Indiana	Lafayette	17 000 00	23 000 00	81 660 64	29 862 11	151 522 75	65 000 00
Iowa	Ames	47 729 75	23 000 00	45 500 00	2 286 73	118 516 48	20 000 00
Kansas	Manhattan	27 716 59	23 000 00	31 783 54	12 094 04	94 594 17	25 947 61
Kentucky	Lexington	29 616 75	19 655 00	31 675 70	9 358 16	90 315 61	22 650 00
Kentucky	Frankfort	1 255 50	3 335 00	7 404 46	1 944 91	13 939 87	4 911 13
Louisiana	Baton Rouge						
Louisiana	New Orleans		11 862 00	9 000 00	200 00	21 062 00	500 00
Maine	Orono	5 915 00	23 000 00	20 000 00	25 130 52	74 045 52	10 850 00
Maryland	College Park	6 142 30	23 000 00	18 500 00	30 701 73	78 344 03	15 000 00
Massachusetts	Amherst	10 976 15	15 333 33	15 000 00	2 183 60	43 493 08	600 00
Massachusetts	Boston	40 131 37	8 000 00	25 000 00	257 867 03	330 998 40	884 000 00
Michigan	Agricultural College	46 842 92	23 000 00	11 000 00	18 828 84	99 671 76	93 234 38
Minnesota	Minneapolis	56 277 68	24 000 00	149 000 00	76 216 06	305 493 74	80 401 00
Mississippi	Agricultural College	5 914 50	10 681 41	20 500 00	14 892 80	51 988 71	8 958 41
Mississippi	Westside	17 814 50	12 000 00			29 814 50	
Missouri	Columbia	17 594 10	22 719 90	10 000 00	1 200 00	51 514 00	5 300 00
Missouri	Rolla	5 010 36	5 679 97	8 000 00	8 469 58	27 159 91	2 600 00
Missouri	Jefferson City		1 233 18	17 275 00	138 50	18 646 68	
Montana	Bozeman		23 000 00	12 000 00	3 000 00	38 000 00	23 000 00
Nebraska	Lincoln	38 500 00	24 000 00	282 000 00	7 500 00	352 000 00	52 500 00
Nevada	Reno	4 253 00	23 000 00	32 500 00	1 250 00	61 003 00	2 933 48
New Hampshire	Durham	7 278 00	23 000 00	5 500 00	14 589 44	50 367 44	8 553 83
New Jersey	New Brunswick	6 480 00	23 000 00		20 439 47	49 919 47	45 729 30

New Mexico	Mesilla Park	.....	23 000 00	4 647 28	1 272 74	28 920 02	21 935 00
New York	Ithaca	375 661 82	23 000 00	.....	170 646 04	569 307 86	288 807 36
North Carolina	West Raleigh	7 500 00	14 936 20	10 000 00	6 048 66	38 484 86	10 000 00
North Carolina	Greensboro	.....	8 414 40	12 500 00	250 00	21 164 40	.....
North Dakota	Agricultural College	.....	23 000 00	27 000 00	3 277 32	53 277 32	2 500 00
Ohio	Columbus	32 973 11	23 000 00	185 623 61	220 579 07	462 175 79	265 887 40
Oklahoma	Stillwater	.....	23 000 00	500 00	.....	23 500 00	5 093 83
Oregon	Corvallis	12 577 95	23 000 00	5 000 00	1 161 47	41 739 42	2 199 79
Pennsylvania	State College	25 637 43	23 000 00	40 150 00	10 158 54	98 945 97	3 000 00
Rhode Island	Kingston	2 941 60	23 000 00	21 500 00	12 522 40	59 964 00	21 861 40
South Carolina	Clemson College	9 276 36	11 500 00	50 000 00	3 387 04	74 163 40	9 100 00
South Carolina	Orangeburg	5 754 00	11 500 00	10 000 00	1 00	27 255 00	3 000 00
South Dakota	Brookings	.....	23 000 00	17 500 00	10 603 49	51 103 49	8 000 00
Tennessee	Knoxville	25 410 00	23 000 00	.....	10 988 22	59 398 22	3 943 50
Texas	College Station	14 280 00	17 250 00	20 000 00	42 185 00	93 715 00	28 655 00
Texas	Prairie View	.....	.....	.....	.....	.....	.....
Utah	Logan	.....	23 000 00	12 250 00	6 175 47	41 425 47	.....
Vermont	Burlington	30 074 15	23 000 00	6 000 00	19 173 62	78 247 77	18 450 00
Virginia	Blocksburg	20 658 72	15 333 34	15 000 00	11 592 97	62 585 03	3 769 50
Virginia	Hampton	39 555 58	7 666 66	.....	99 296 16	146 518 40	275 132 18
Washington	Pullman	.....	23 000 00	27 500 00	9 000 00	59 500 00	5 472 26
West Virginia	Morgantown	6 408 00	18 000 00	36 550 00	12 360 08	73 318 08	17 035 00
West Virginia	Farm	.....	5 000 90	15 000 00	600 00	20 600 00	54 200 00
Wisconsin	Madison	23 990 97	24 000 00	283 287 00	48 798 70	380 076 67	58 000 00
Wyoming	Laramie	.....	23 000 00	8 076 69	1 166 73	32 243 42	8 577 51
	Total	$1 232 613 16	$1 108 610 38	$2 370 719 39	$1 306 436 97	$6 018 379 20	$2 796 350 97

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